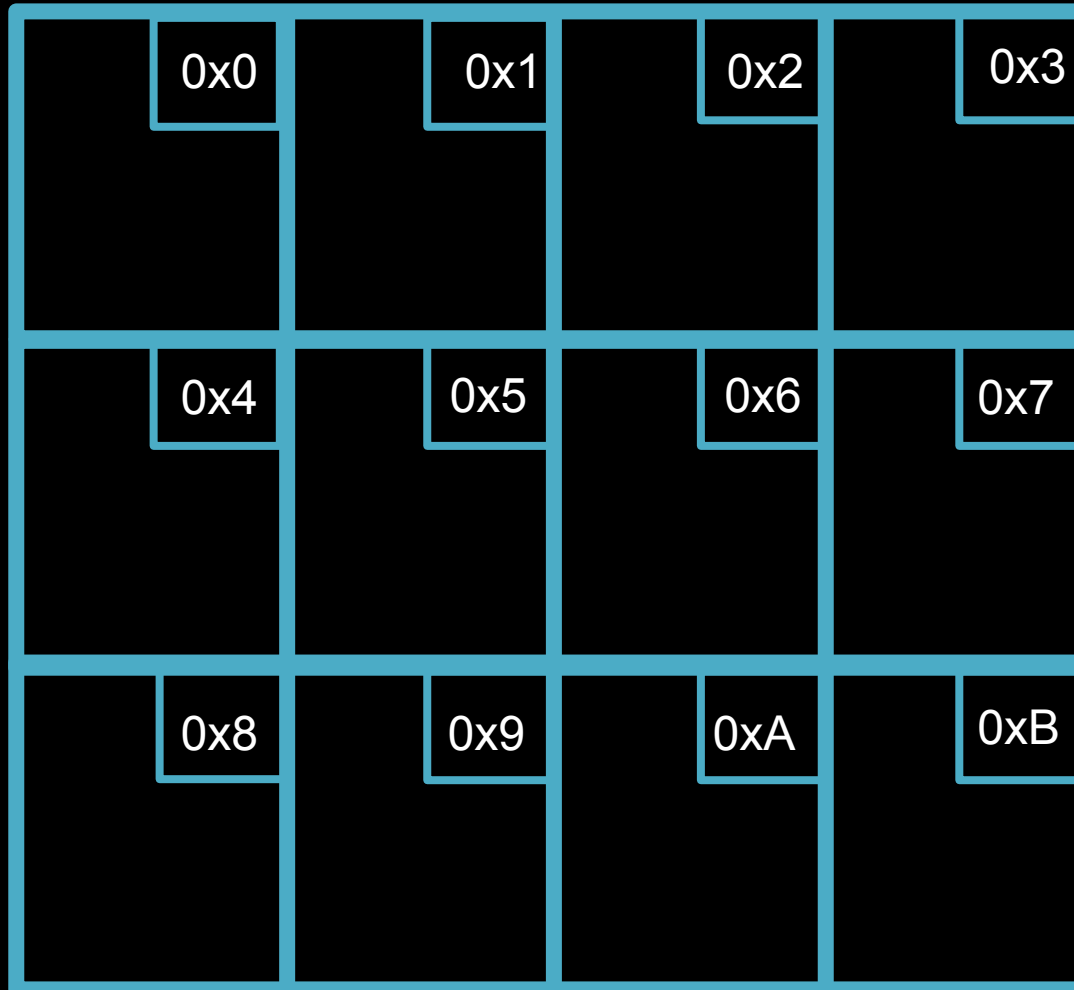


# Pointers



# Memory



MAN, I SUCK AT THIS GAME.  
CAN YOU GIVE ME  
A FEW POINTERS?

0x3A28213A  
0x6339392C,  
0x7363682E.

I HATE YOU.



# Creating Pointers

Declaring pointers:  
`<type>* <variable name>`

Examples:

```
int* x;
```

```
char* y;
```

```
float* z;
```

# Referencing and Dereferencing

**Referencing:**  
**&<variable name>**

**Dereferencing:**  
**\*<pointer name>**

# Under the hood...


```
int x = 5;
```

```
int* ptr = &x;
```

```
int copy = *ptr;
```

| Variable | Address | Value |
|----------|---------|-------|
| x        | 0x04    | 5     |
| ptr      | 0x08    | 0x04  |
| copy     | 0x0C    | 5     |

# Track the values

|                           | <b>x</b>  | <b>ptr</b>  |
|---------------------------|-----------|---|
| <b>int x = 5;</b>         | <b>5</b>  |  |
| <b>int* ptr = &amp;x;</b> | <b>5</b>  | <b>&amp;x</b>   |
| <b>*ptr = 35;</b>         | <b>35</b> | <b>&amp;x</b>   |

# Test Yourself

|    | a | b | c | pa | pb | pc |
|----|---|---|---|----|----|----|
| 1. |   |   |   |    |    |    |
| 2. |   |   |   |    |    |    |
| 3. |   |   |   |    |    |    |
| 4. |   |   |   |    |    |    |
| 5. |   |   |   |    |    |    |
| 6. |   |   |   |    |    |    |
| 7. |   |   |   |    |    |    |



# Answers

```
int a = 3, b = 4, c = 5;
```

```
int* pa = &a, *pb = &b, *pc = &c;
```

|                                 | a     | b   | c     | pa | pb | pc |
|---------------------------------|-------|-----|-------|----|----|----|
| <code>a = b * c;</code>         | 20    | 4   | 5     | &a | &b | &c |
| <code>a *= c;</code>            | 100   | 4   | 5     | &a | &b | &c |
| <code>b = *pa;</code>           | 100   | 100 | 5     | &a | &b | &c |
| <code>pc = pa;</code>           | 100   | 100 | 5     | &a | &b | &a |
| <code>*pb = b * c;</code>       | 100   | 500 | 5     | &a | &b | &a |
| <code>c = (*pa) * (*pc);</code> | 100   | 500 | 10000 | &a | &b | &a |
| <code>*pc = a * (*pb);</code>   | 50000 | 500 | 10000 | &a | &b | &a |

# Pointer Arithmetic

Adding/subtracting  $n$  adjusts the pointer by

$n * \text{sizeof}(\langle \text{type of the pointer} \rangle)$  bytes

|                               | x | y    |
|-------------------------------|---|------|
| <code>int x = 5;</code>       | 5 |      |
| <code>int* y = &amp;x;</code> | 5 | 0x04 |
| <code>y += 1;</code>          | 5 | 0x08 |

# What will print?

```
int main(void)
{
    char* str = "happy cat";
    int counter = 0;

    for (char* ptr = str; *ptr != '\0'; ptr++)
    {
        counter++;
    }

    printf("%d\n", counter);
}
```

# Pointers and Arrays

```
int array[3];  
  
*array = 1;  
*(array + 1) = 2;  
*(array + 2) = 3;
```

